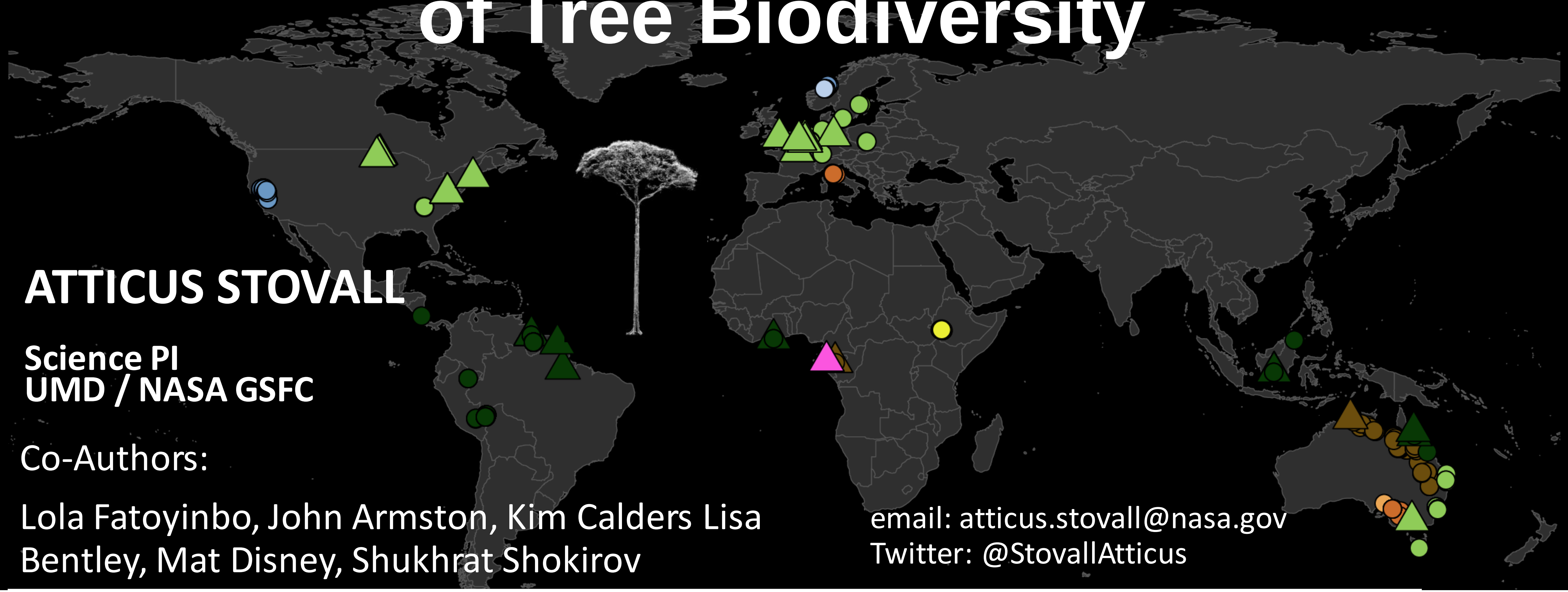
Understanding the Global 3D Signature of Tree Biodiversity



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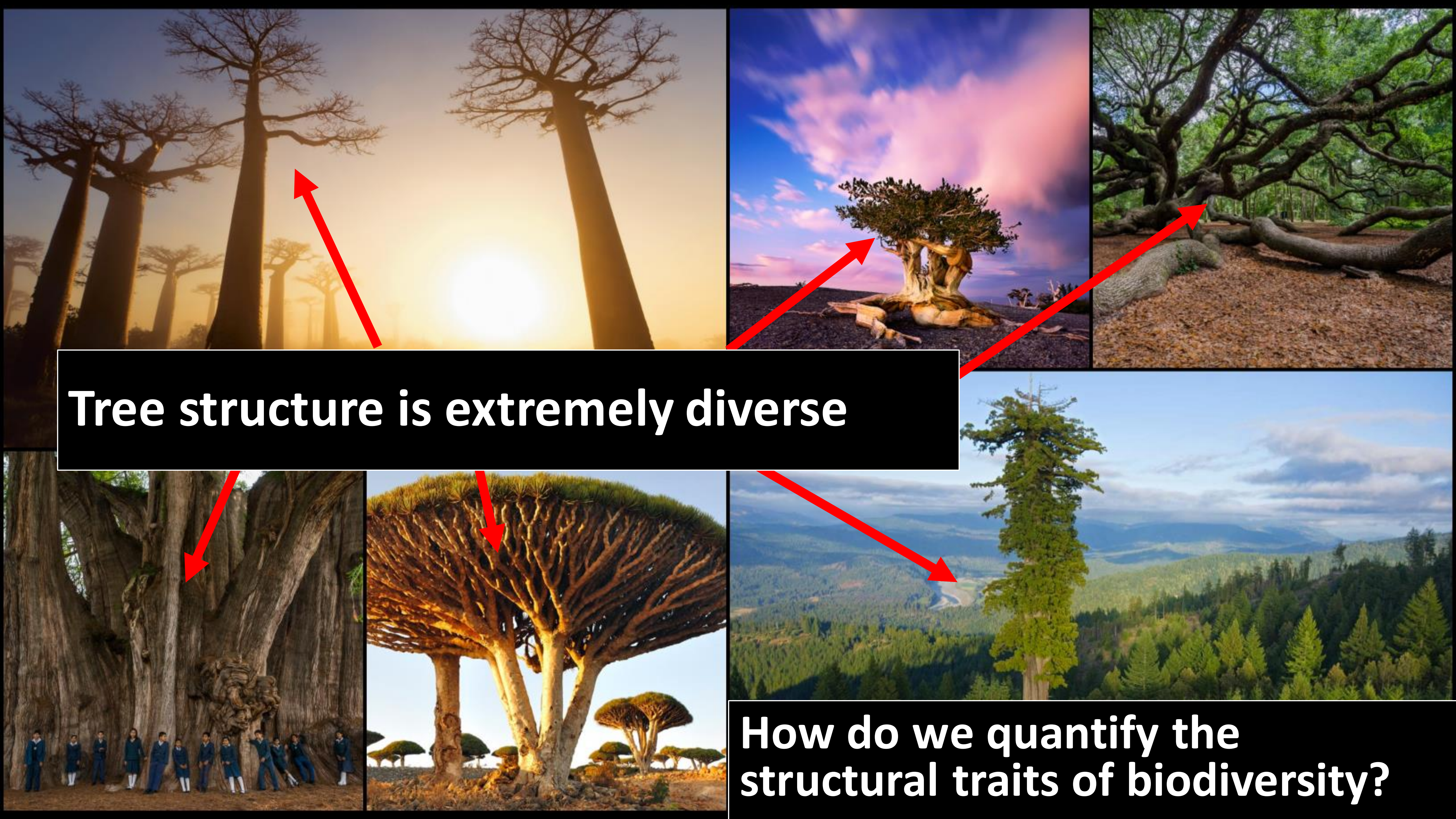
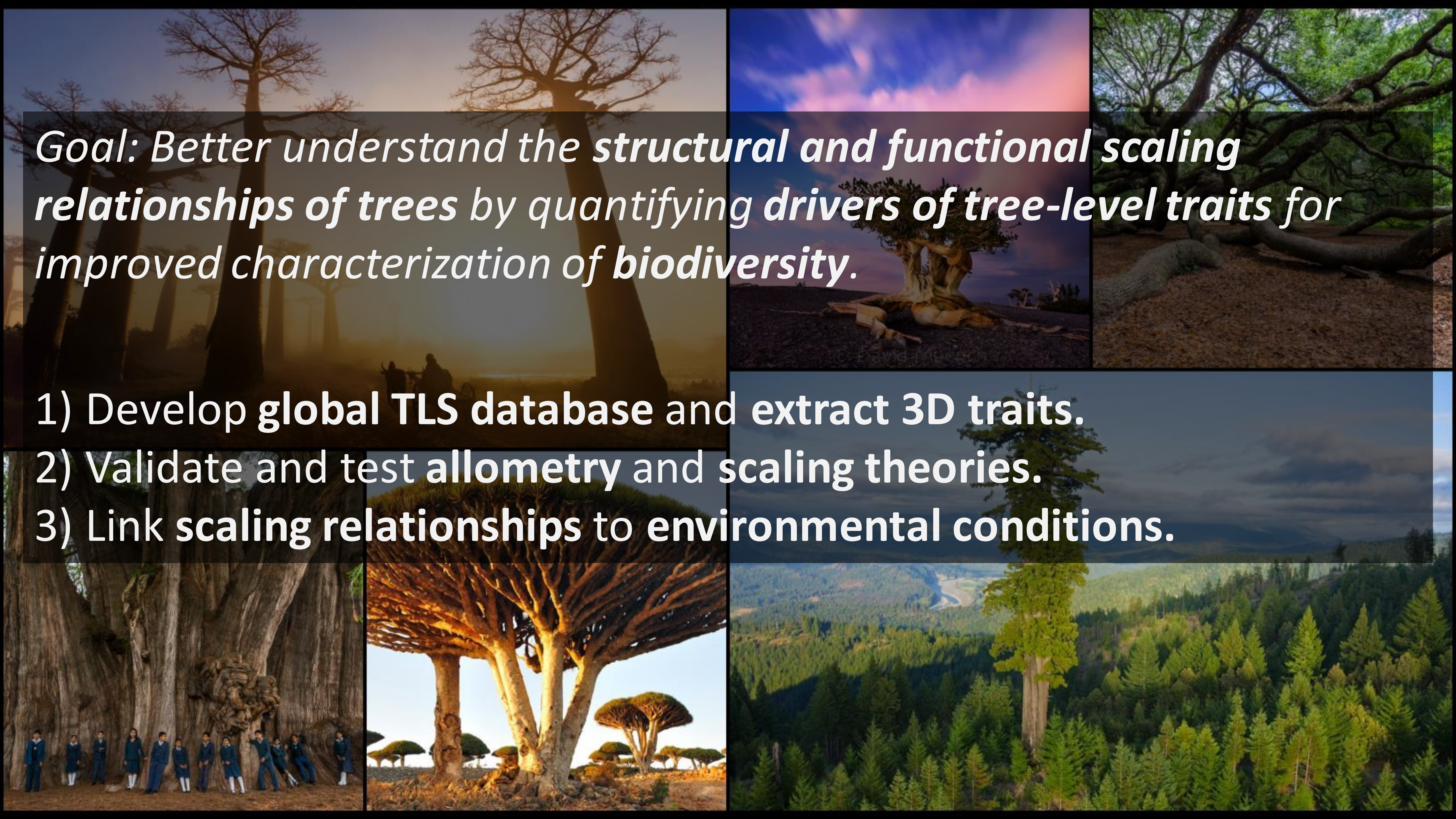
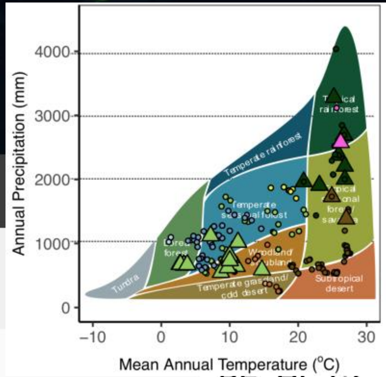

Tree structure is extremely diverse
How do we quantify the structural traits of biodiversity?

Terrestrial laser scanning brings 3D to biodiversity traits



*Goal: Better understand the **structural and functional scaling relationships of trees** by quantifying **drivers of tree-level traits** for improved characterization of **biodiversity**.*

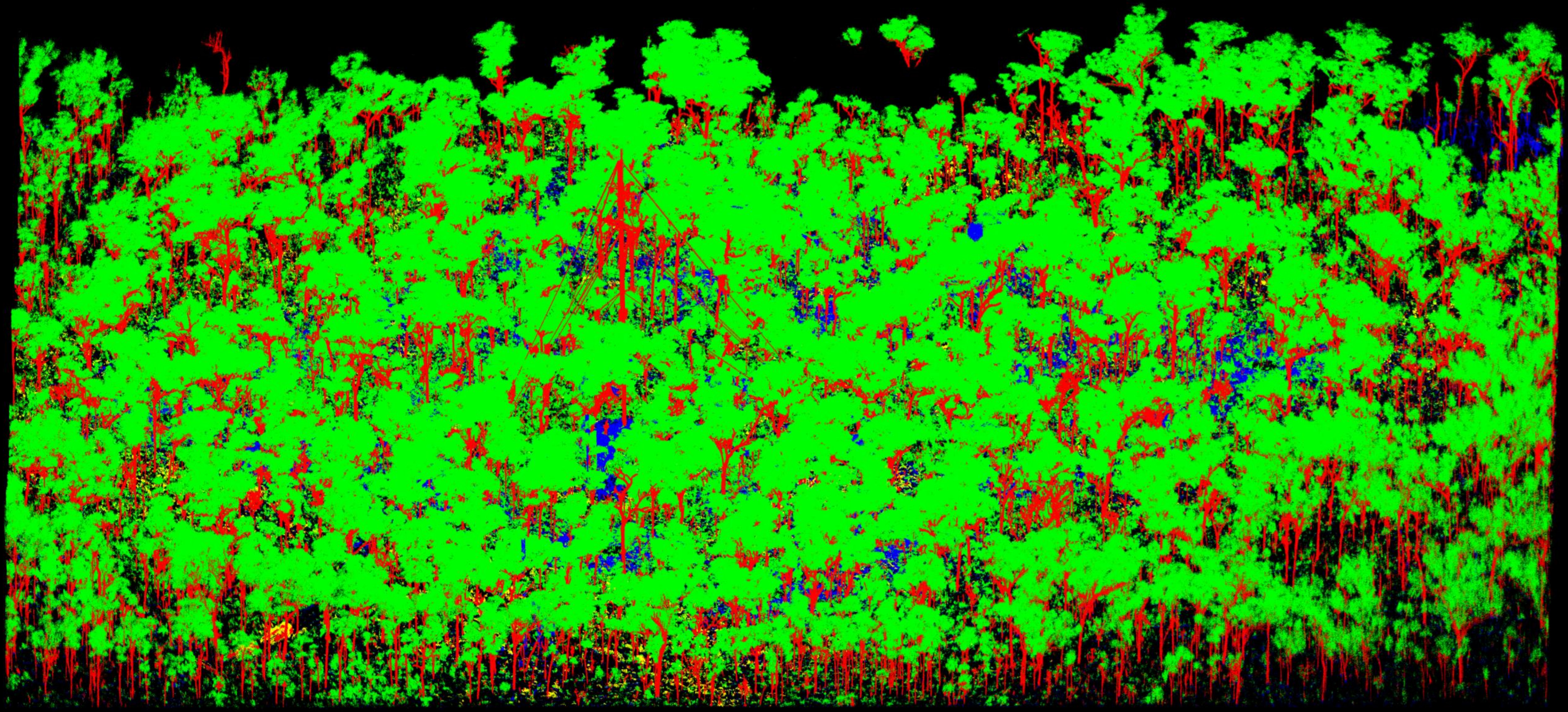
1) Develop **global TLS database** and **extract 3D traits.**
2) Validate and test **allometry** and **scaling theories.**
3) Link **scaling relationships** to **environmental conditions.**



We have assembled a **global** dataset

- 1st year grew by **106 TLS plots to 1108!**
- 57 members (47 with TLS data) and 40 institutions have joined
- Manuscript in-prep introducing TLS database

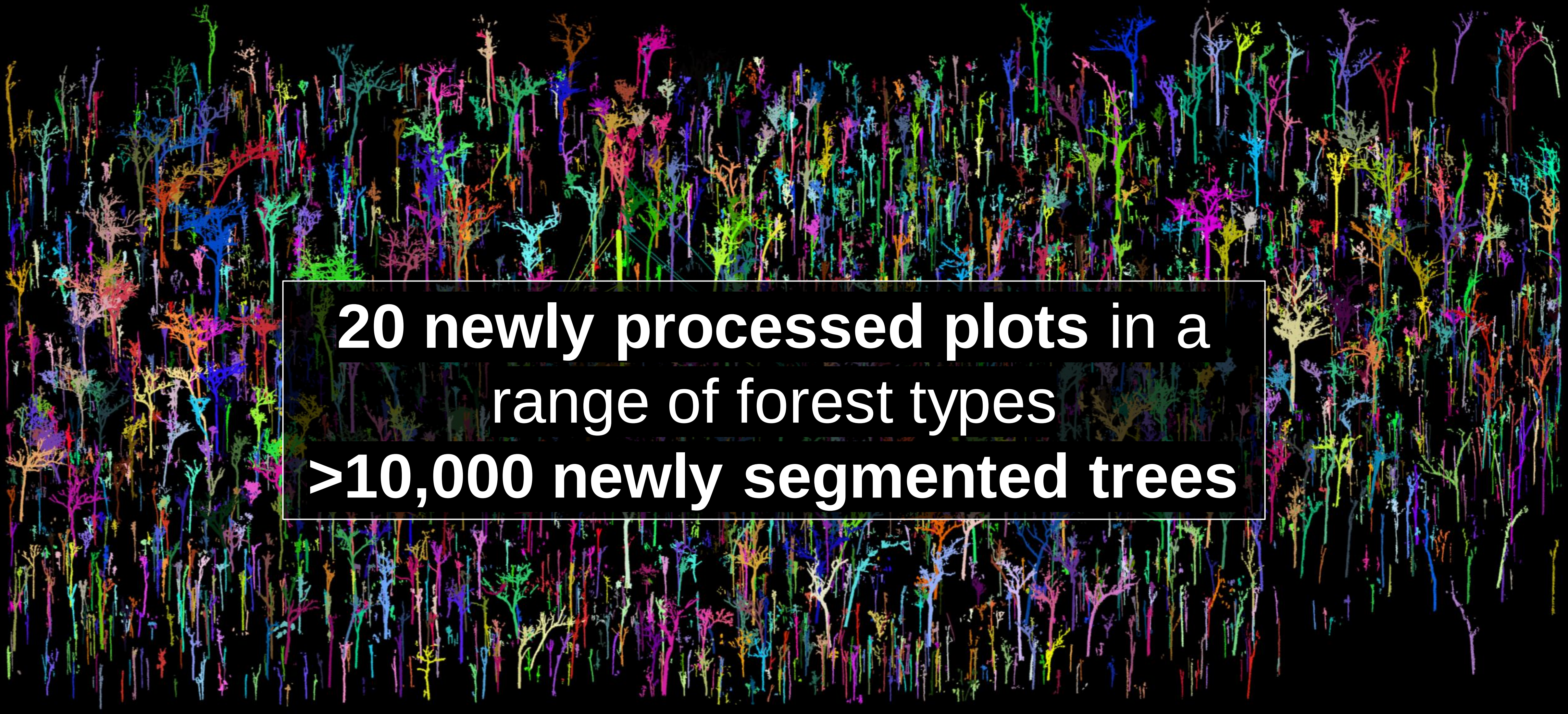
Separating trees into **Leaf** and **Wood**



Separating trees into **Individuals**

Manuscript in-prep comparing 4 segmentation algorithms

Woody structure for **architectural traits**

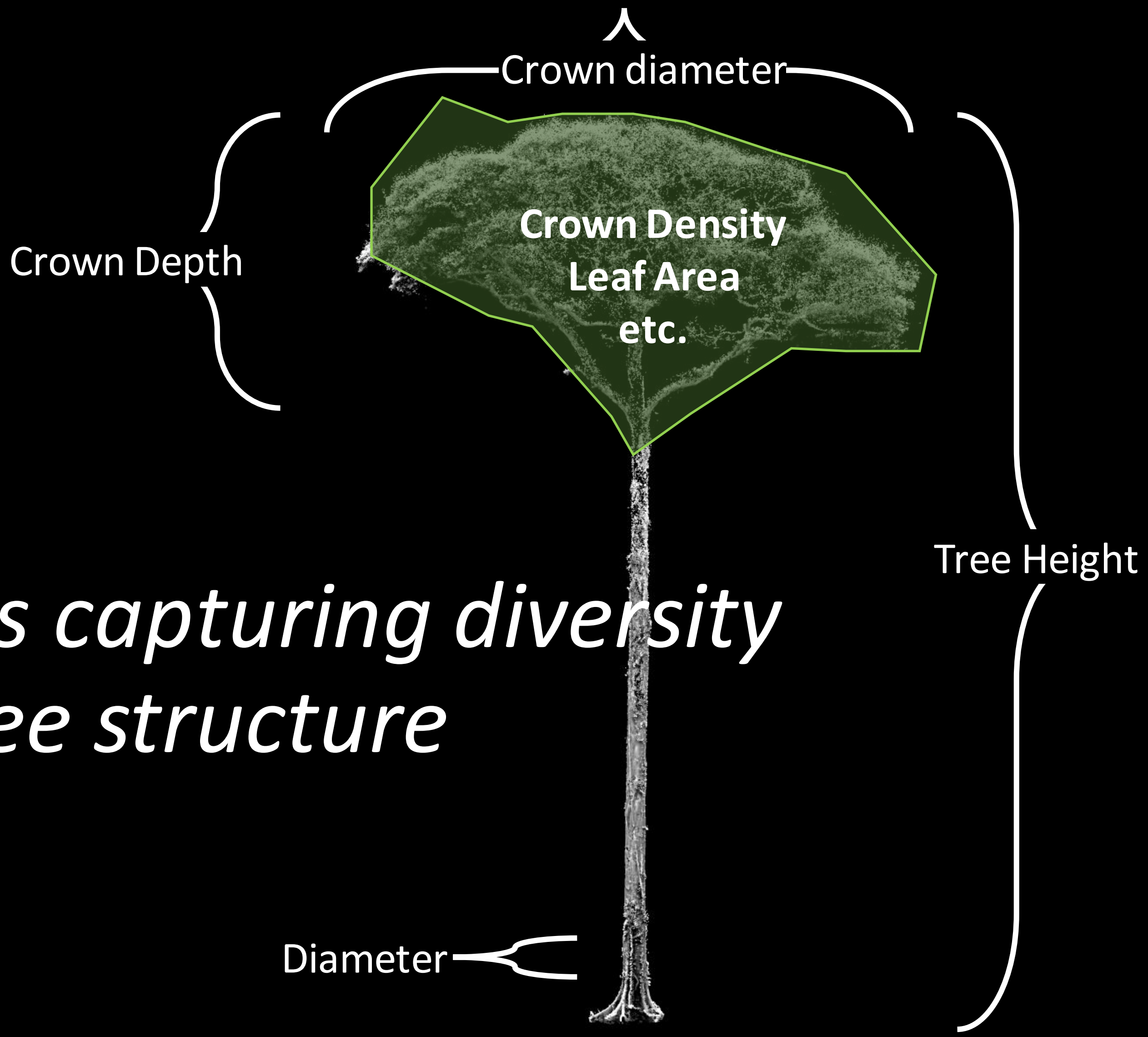


20 newly processed plots in a range of forest types

>10,000 newly segmented trees

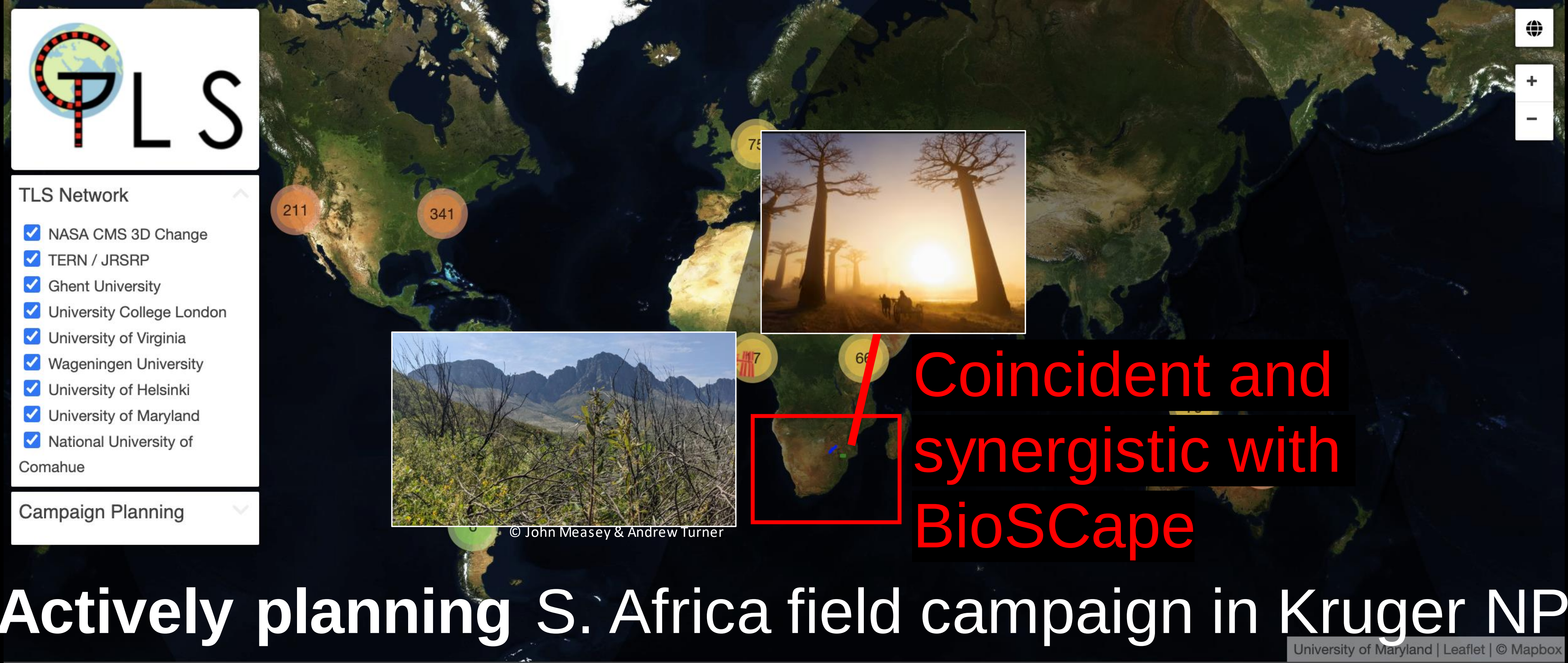
Tree-level Structural Biodiversity Traits (SBTs)

SBTs
Top-heaviness
Aspect ratio
Relative Crown Width
Crown Area
Leaf Area
Crown Density
Mass Taper Exponent
Path Fraction
Crown Asymmetry
Branching Angle



Traits capturing diversity of tree structure

We are developing a standardized processing framework for all Co-Is, Collaborators, and GTLS members to apply



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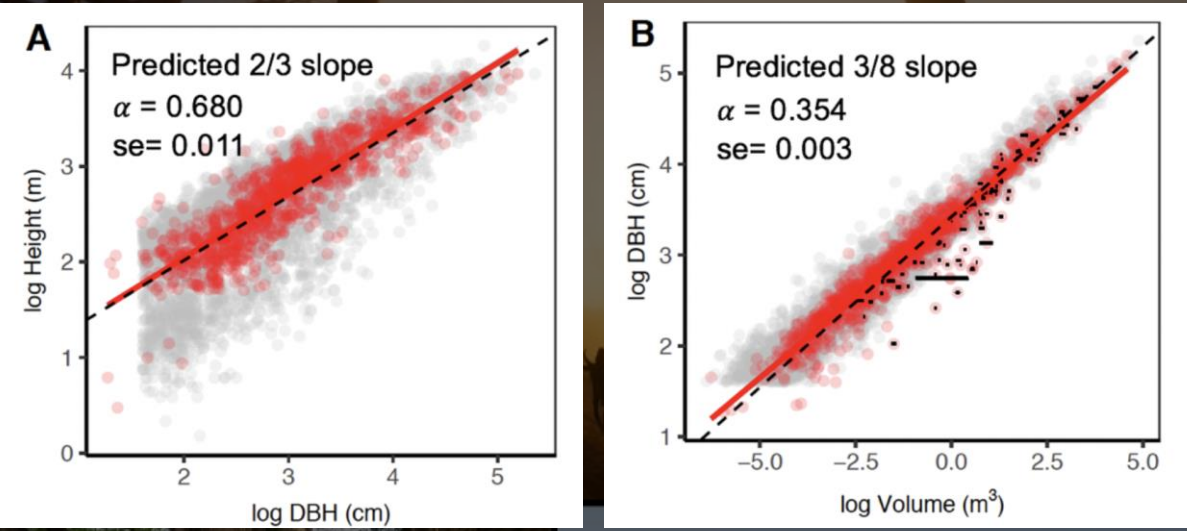
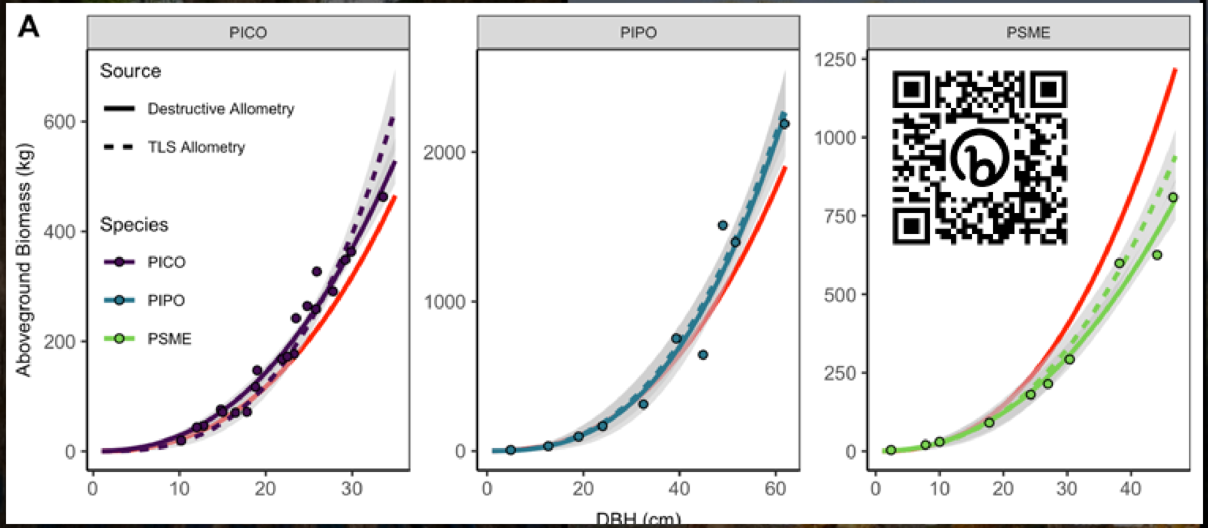
Coincident and synergistic with BioSCape

Actively planning S. Africa field campaign in Kruger NP

Group	Name	Datetime	Instrument	Protocol	Area	QSM	Open
Ghent University	BE_HI_T1	2018-07-04T00:00:00	RIEGL VZ400	edge_core_transect_100m_5scans	0.00	No	contact:kim.calders@ugent.be;Pieter.[illegible]
Ghent University	BE_HI_T2	2018-07-04T00:00:00	RIEGL VZ400	edge_core_transect_100m_5scans	0.00	No	contact:kim.calders@ugent.be;Pieter.[illegible]
Ghent University	BE_HI_T3	2018-07-04T00:00:00	RIEGL VZ400	edge_core_transect_100m_5scans	0.00	No	contact:kim.calders@ugent.be;Pieter.[illegible]
Ghent	[illegible]	2018-07-	RIEGL	[illegible]	[illegible]	[illegible]	[illegible]

2) We are beginning to validate local and national-scale allometry at study sites in the GTLS database.

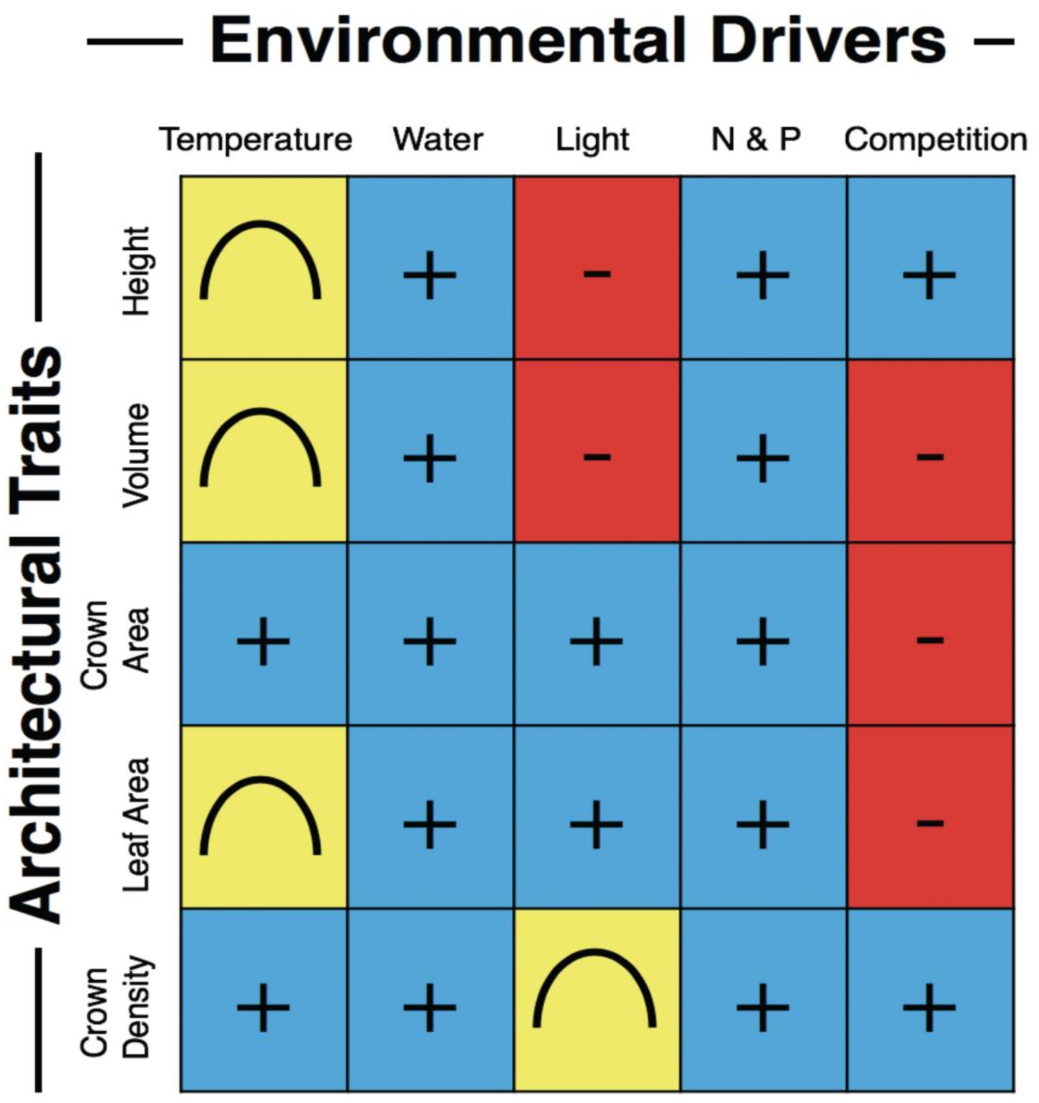


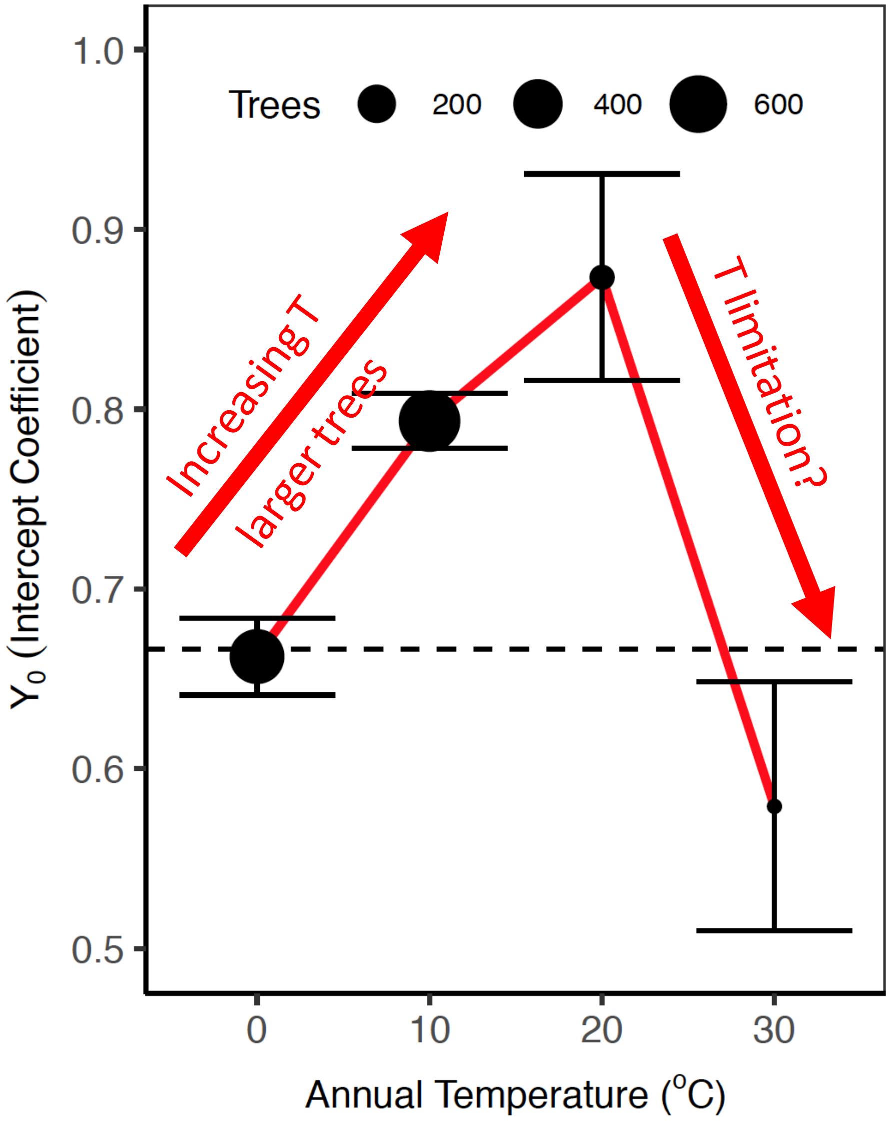


- ☑ **Test metabolic scaling theories (ongoing)**
- ☑ **Validate Local and National Allometric Relationships (ongoing)**

Stovall et al. 2022 (*Methods in Ecology and Evolution)*

Link **scaling relationships** to **environmental conditions.**





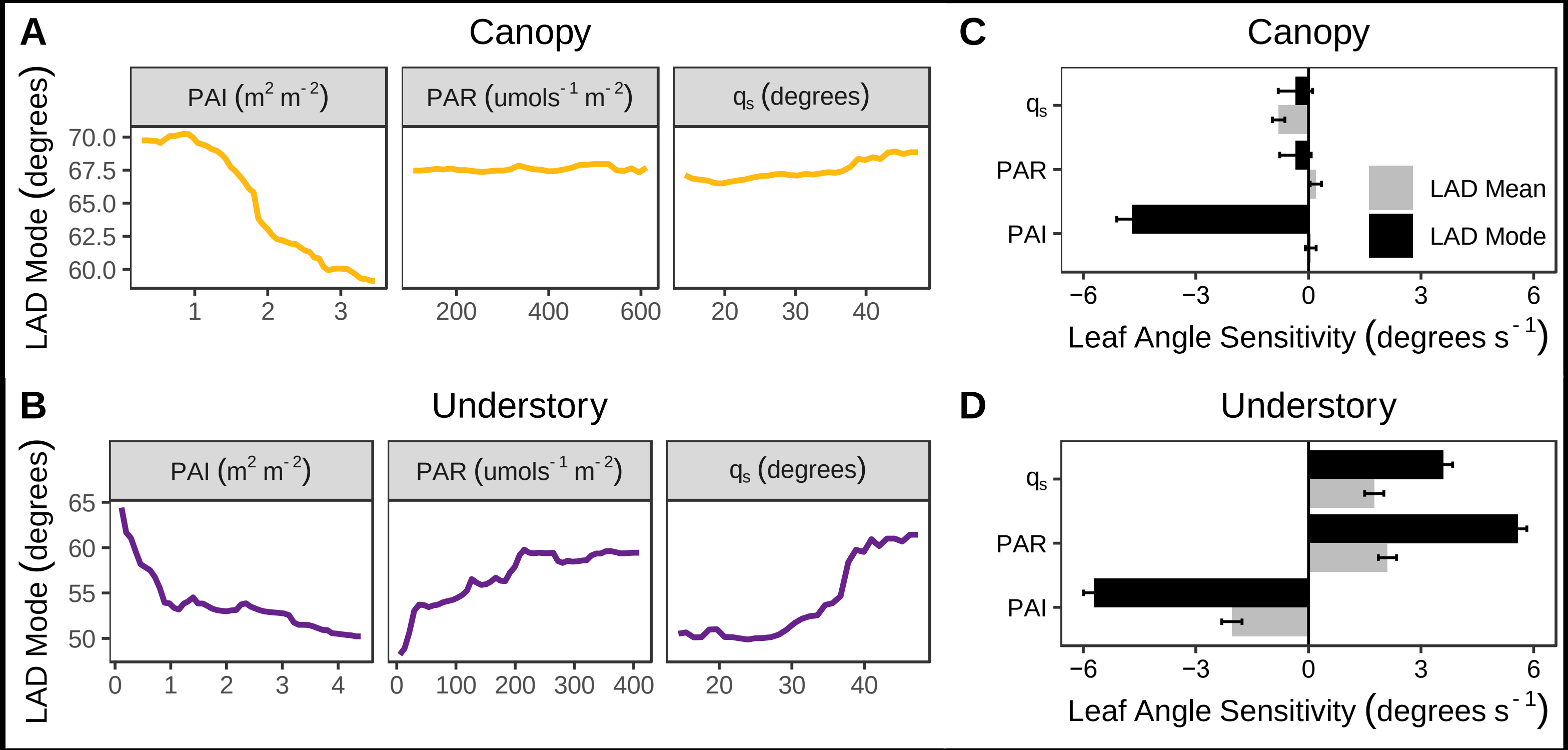
What environmental factors control leaf angle?

3 manuscripts focusing on leaf angle as a new measurable structural biodiversity trait

TLS LeAF

Stovall AEL,..Fatoyinbo L, Yang X (2021) New Phytologist.doi:10.1111/nph.17548

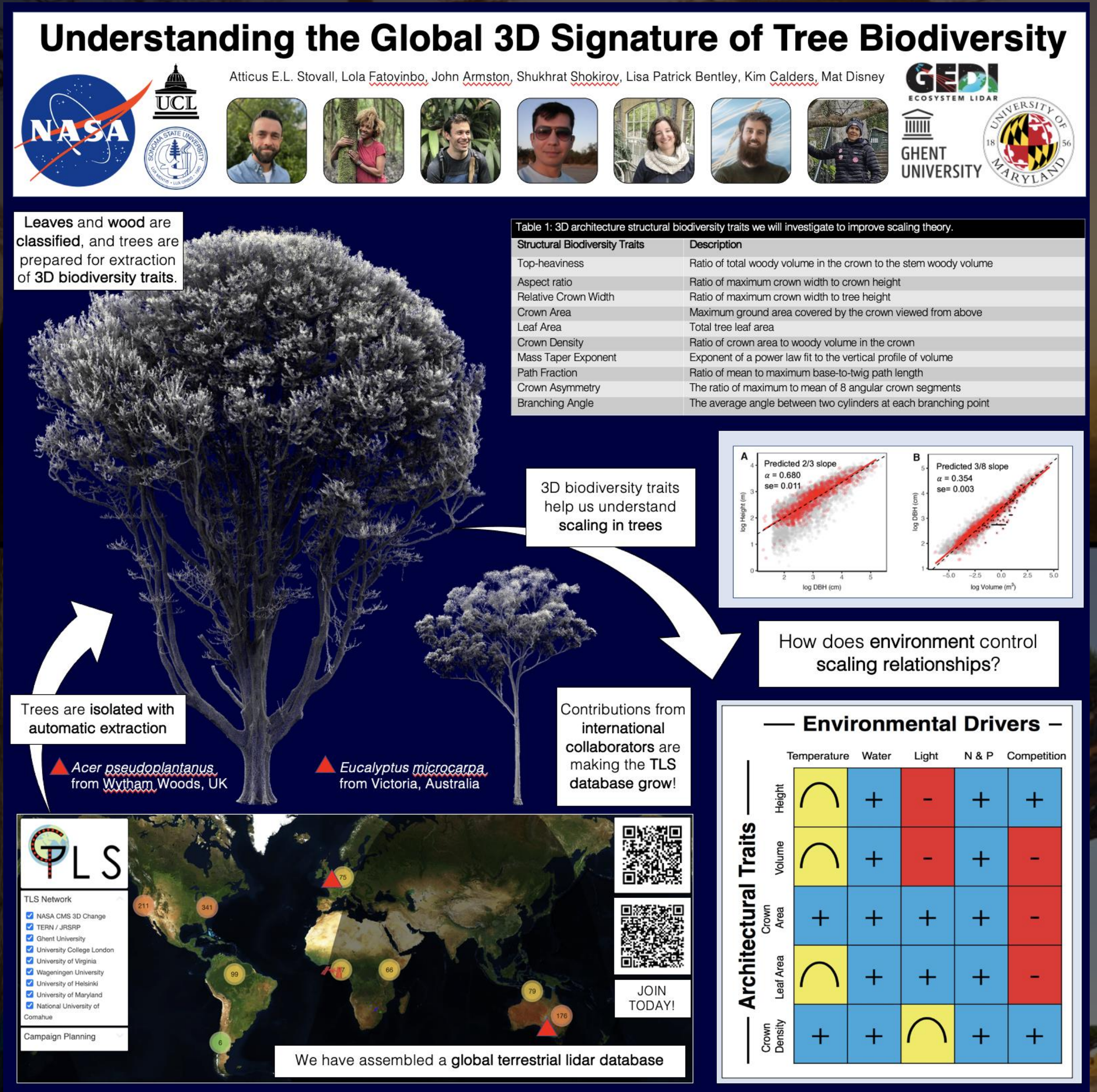
Yang X, Li R, Jablonski A, et al (2023) Ecology Letters: doi: 10.1111/ele.14215

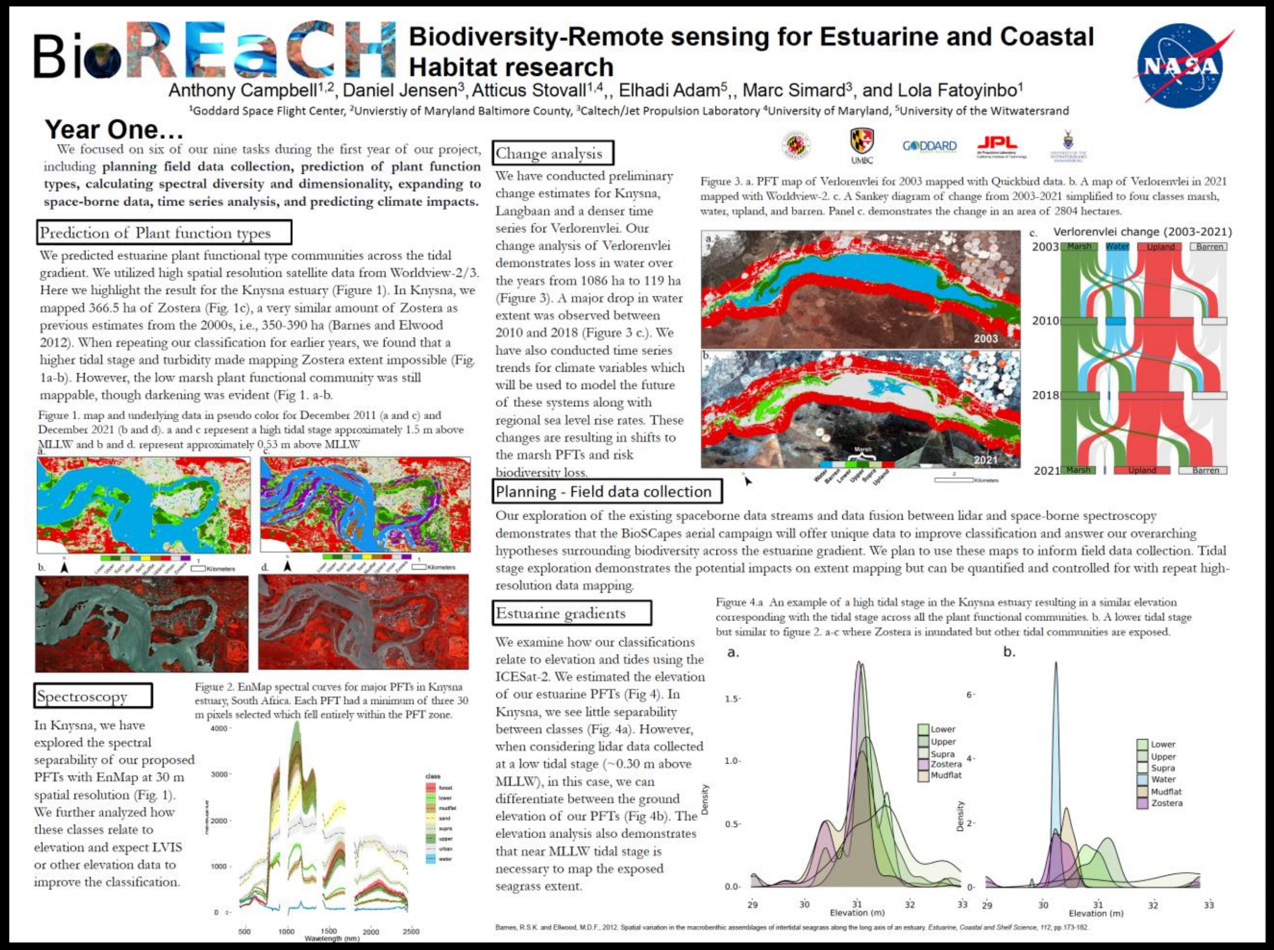


Sensitivity of [A] canopy and [B] understory leaf angle mode (the most commonly observed leaf angle) to seasonal shifts in plant area index (PAI), photosynthetically active radiation (PAR), and solar inclination angle (θ_s).

Stovall et al. Submitted to *New Phytologist*

For more, chat with us at the poster session!





Tuesday and Thursday Afternoon

Thanks to all current contributors:

NASA GSFC
Terrestrial Ecosystem Research Network
University College London
University of Virginia
University of Nevada Reno
Wageningen University

We look forward to more!

For more information, contact:
Atticus.E.Stovall@NASA.gov

Sign up!

GTLS Map

NASA · University of Maryland · Ghent University · UCL · Sonoma State University · GEDI Ecosystem Lidar · GTLS